

The lines whose focus is  $P_1$  are curves of equal latitude, and those whose focus is  $S_1$  are Sumner lines. Suppose systems of both kinds of lines to be drawn, the figure will be divided into small quadrilaterals, and the eye, aided by a scale with small divisions, would approximately determine the point within any quadrilateral at which the values of  $c$  and  $z$  are given, intermediate between those of the bounding sides. It is difficult to estimate the error to which this determination would be liable, but supposing the linear dimensions of a quadrilateral at a distance of 10 inches from  $P_1$  were comparable with the tenth of an inch and that an error of one-hundredth of an inch were committed in the direction  $\perp^r$  to  $P_1Z_1$ , this would mean an error of 3 or 4 minutes in the measured value of the hour angle. This error would be important, but not large enough to condemn the method, and the estimate shows that the scale of the diagram should be as large as is practicable.

If we confine the diagram to points in north latitudes  $c$  may be taken to range between  $30^\circ$  and  $90^\circ$ , though it would obviously be desirable also to draw a few lines for which  $c$  is  $>90^\circ$ . The range of  $z$  may be taken between  $10^\circ$  and  $80^\circ$ . The distance between the foci is, as we have seen,  $\tan \frac{1}{2} \rho$  and the distance between the directrices is readily proved to be  $\cot \frac{1}{2} \rho$ . The consideration which determines the scale on which the curves should be drawn is that the Sumner for which  $z = 80^\circ$  should appear in the diagram as far as it may be required.

The curves in each diagram are different from those in every other for different values of  $\rho$ ; for although it might at first appear that since the distance from the focus to the directrix is the same for  $180^\circ - \rho$  as it is for  $\rho$  some saving would be effected, the indications of the same curves in the two cases are different, and the Sumners are placed differently in regard to the parallels of latitude. In the case of the sun a diagram for every ten minutes change in declination would probably be necessary, and this would mean an enormous amount of work. Diagrams for a few of the best stars could, however, be constructed on this principle and would be extremely useful.

It will have been noticed that the angle  $Z_1S_1P_1$  is equal to the angle  $ZSP$  in the spherical figure, but the azimuth is not represented in the plane figure. The following properties of the plane curves may therefore be stated:—

(1) The angle at which  $S_1Z_1$  cuts the sumner at  $Z_1$  is equal to the angle at which  $P_1Z_1$  cuts the parallel of latitude.

(2) If a tangent at  $Z_1$  be drawn to either curve, say the sumner, to cut  $S_1P_1$  in  $T$  and perpendiculars be drawn from  $T$  to  $Z_1P_1$ ,  $Z_1S_1$  meeting them in  $M$  and  $N$ , then

$$\cos(\text{azimuth}) = \mp \frac{TM}{TN}$$

according as  $T$  falls between  $S_1$  and  $P_1$  or not. From this result a graphical determination of the azimuth is easily obtained.

4. If we take  $Z_1P_1$  for base line the curves to be drawn are curves of altitude and polar distance. This method of representation is tempting as the angles at  $P_1$  and  $Z_1$  are then the hour angle and azimuth. Moreover it would be a very convenient way of producing the diagrams to arrange them for consecutive values of the colatitude. Unfortunately there are serious objections. Suppose the common directrix of the polar distance lines cuts  $P_1Z_1$  produced in  $X$ , then when the sun is in the southern hemisphere these lines are hyperbolas on the remote side of the directrix from  $P_1$  and they diverge rapidly for consecutive values of  $\rho > 90^\circ$ ; so much so that, when the colatitude is between  $30^\circ$  and  $40^\circ$ , it is impossible to represent them on a scale which would be of any value. For places in the tropics there would not be the same objection, and diagrams drawn on this principle would be convenient in those regions.

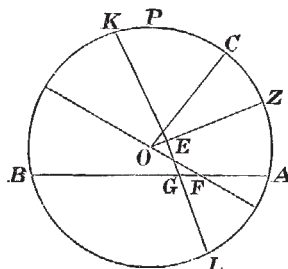
There is another difficulty. In winter, in northern latitudes, the azimuth and hour angle may be together greater than two right angles or, what is equivalent,  $\rho + z$  may be  $>180^\circ$ . In that case the construction we are going upon fails, although it is possible to meet the difficulty.

The point is interesting, and admits of the following explanation:—In the figure  $P$  is the north pole,  $Z$  the place of observation,  $AB$  the diurnal path of the sun. If  $C$  be the middle point of  $PZ$ , then all points above the plane through the centre  $O$  perpendicular to  $OC$  may appear in the plane diagram supposed large enough. Again a plane  $KL$  perpendicular to  $OZ$  corresponding to  $z=80^\circ$  limits the area in which observations may be taken. If, therefore, the sun were observed between  $F$  and  $G$

he would be out of the diagram, and this means that  $\rho + z > 180^\circ$ .

The difficulty may be overcome by solving graphically another triangle  $S_1P_1Z_1$  corresponding to  $S^1PZ$  in the spherical figure where  $S^1$  is diametrically opposite to  $S$ . For, if  $SZP + SPZ > 180^\circ$  then  $S^1PZ + S^1PZ < 180^\circ$ . Hence, if we interchange  $Z_1$  and  $P_1$  in the diagram and pick out the intersection of the curves  $180^\circ - z$  and  $180^\circ - \rho$  we shall thereby find graphically the supplements of the hour angle and azimuth.

5. To these modes of representation may be added stereographic projection on the plane of the equator which admits of lines of equal latitude and Sumner lines being represented by



systems of circles and of two angles of the spherical triangle being represented in the corresponding plane figure.

6. The object of all such methods is to facilitate the drawing of lines of position on a Mercator's chart, and as the hour angle must be determined with the greatest possible precision, the diagram should be on a large scale with hour angle lines drawn upon it at suitable intervals.

With this in mind the most practical of the foregoing methods would seem to be the first, viz. that in which there is a single diagram, cut into sections, not necessarily on the same scale, but large enough to admit of the hour angle lines and perhaps also azimuth lines being drawn upon it.

## ANTHROPOLOGICAL USES OF THE CAMERA.

AN interesting paper on the anthropological uses of the camera was lately read by Mr. E. F. im Thurn before the Anthropological Institute of Great Britain and Ireland, and is now reprinted in the Institute's "Journal."

Mr. im Thurn points out that primitive phases of life are fast fading from the world in this age of restless travel and exploration, and urges that it should be recognised as almost the duty of educated travellers in the less known parts of the world to put on permanent record, before it is too late, such of these phases as they may observe. It is certainly, however, he says, not a sufficiently recognised fact that such records, usually made in writing, might be infinitely helped out by the camera.

As illustrating the small use of the camera for this special purpose, Mr. im Thurn calls attention to the almost universal badness of illustrations of living primitive folk in books of anthropology and travel, when these illustrations are not merely what may be called physiological pictures. Of old the book illustrator, if, as was usual, he was not himself the traveller, drew as pictures of primitive folk, merely the men and women that surrounded him, drew figures of men and women of his own stage of civilisation, and merely added to these such salient features as he was able, from the traveller's tales, to fancy that his supposed primitive subjects had. So in 1599 the imaginative artist of Nuremberg who drew the pictures for the rare Latin abbreviation of Sir Walter Raleigh's "Discoverie of Guiana" gave to the world his impressions of the "Amazons," the "Headless Men," and the "Men who dwelt on trees" which are typical of the pictures of "savages" which adorn the travellers' books up to nearly the present century.

Mr. im Thurn refers also to the beautifully executed illustrations by Bartolozzi in Stedman's "Dutch Guiana," in which, in place of natives, are shown, with the necessary change of dress, simply Europeans of more than average beauty of form. There were doubtless exceptions to the misrepresentation of primitive folk, and the greatest of these exceptions known to Mr. im Thurn is the beautiful series of drawings by Catlin of North American Redmen. But Catlin enjoyed the unusual advantage not only of considerable technical skill as an artist,

but of living among the folk whom he drew and about whom he wrote. Even his drawings, valuable as they are, and artistically superior as they are, are far from having the value of the accuracy of photographs.

The modern anthropological illustrator does indeed generally draw from photographs; but almost always from photographs taken under non-natural conditions. Mr. im Thurn mentions as an example a picture of the Caribs of his own country of Guiana, which appears in one of the most valuable and accurate of recent anthropological books. This picture was the best attainable, and is evidently taken from a photograph; yet it gives no hint of what Caribs are like in their natural state. The explanation is easy. During Mr. im Thurn's many years' acquaintance with these Caribs, both in their native wilds and during their brief visits to the town, he has often been struck by the marvellous difference in their appearance when seen under these two differing conditions. It is true that in his natural surroundings the Carib is but very lightly clad, whereas, on the rare occasions when he enters the town he sometimes, but by no means always, puts on a fragmentary and incongruous piece or two of the cast-off clothing of white men, intending, by no means successfully, to adorn his person; but such separable accidents of rags by no means explain the full change in his appearance. Mr. im Thurn has seen the same men, in their distant homes on the mountainous savannahs between Guiana and the Brazils, though clothed with but a single strip of cloth, two or three inches wide and perhaps a yard in length, and either unadorned or adorned with but a scrap of red or white paint, look like what the novelists describe as well-groomed gentlemen. Yet the same individuals in Georgetown, without any added clothing or adornment, look the meanest and wretchedest folk imaginable. The sense of shyness and mean cringing fear which in the town doubtless drives out from them their innate sense of freedom and happy audacity, seems to find outward expression and completely to alter their bodily form. And it was quite evidently under some such depressing circumstances as these that the Redmen—who, by the way, were probably Ackawois and not "True Caribs"—who are shown in the illustration referred to, were photographed.

Just as the purely physiological photographs of the anthropometrists are merely pictures of lifeless bodies, so the ordinary photographs of uncharacteristically miserable natives seem to Mr. im Thurn to be comparable to the photographs which one occasionally sees of badly stuffed and distorted birds and animals.

Mr. im Thurn gives a clear and most attractive account of his own photographs of phases of primitive life in Guiana—photographs which, at the time of the reading of his paper, were shown on the screen. The following are some extracts from this part of the paper:—

Fifteen years ago I went out to Guiana as curator of the public museum, and in that capacity travelled much in the interior of that colony, only the seaboard of which was, and very little more now is, inhabited. Ten years ago I entered the service of the Government, and, as magistrate, took charge of a large district inhabited almost solely by Redmen. And I remained under those circumstances until, about two years ago, I was transferred to a neighbouring and still larger district of which it may be said that up to the time of my going there the white men who had visited it might be counted on the fingers of one hand. Throughout this time I have lived really among these pleasant red-skinned folk, now and again, for periods of greater or less duration, living not only among, but as they do; and throughout that period I have had none but Redmen as my servant friends. They have got used to me, and I have got used to them, and doubtless in this respect I have enjoyed greater advantages in the matter of gaining their confidence than the ordinary traveller, who merely passes through a country, could hope to enjoy. Some ten years ago, in a book on the "Indians of Guiana," I told all that I then knew about them. Though of course further experience has now taught me a good deal more about them, I must not here linger on anything that does not touch my special subject of to-night—my experiences as a photographer among them.

That to gain the confidence of uncivilised folk whom you wish to photograph is one of quite the most essential matters you will easily understand. The first time I tried to photograph a Redman was among the mangrove trees at the mouth of the Barima River. My red-skinned subject was carefully posed high up on a mangrove root. He sat quite still while I focussed and

drew the shutter. Then, as I took off the cap, with a moan he fell backward off his perch on to the soft sand below him. Nor could he by any means be persuaded to prepare himself once more to face the unknown terrors of the camera. A very common thing to happen, and to foil the efforts of the photographer at the very moment when he has but to withdraw and to replace the cap, is for the timid subject suddenly to put up his hand to conceal his face, a proceeding most annoying to the photographer, but interesting to the anthropologist, as illustrating the very widespread dread of primitive folk of having their features put on paper, and being thus submitted spiritually to the power of any one possessing the picture.

With reference to my earlier remarks on the difficulty of discerning in the ordinary illustrations the real bodily appearance of uncivilised folk, photographs of the True Caribs of Guiana will be shown on the screen. And in so doing it may, without entering into elaborate detail, be once more pointed out that the red-skinned inhabitants of Guiana are distinguishable into three groups or branches (see "Among Indians of Guiana," p. 159, and "Proceedings of Royal Geographical Society," October, 1892). Though the actual pre-European history of these three is, unfortunately, still greatly a matter of conjecture, it is convenient to use such conjectures as seem most reasonable on this subject as a means of distinguishing the branches—that is to say, it is well to bear in mind that probably of the tribes at present in Guiana the Warraus, who inhabit the swamps about the mouth of the Orinoco, were the earliest occupiers, but that there is at present no evidence at all to show whence these people reached their present homes; that another of the branches, represented only by the Arawacks, who inhabit the whole sea-coast of that country with the exception of the more swampy lands of the Warraus, probably reached their present homes from the West Indian Islands long after the Warraus were already established in those parts; and that the third branch, usually called the Carib branch, and represented by the Ackawois, Macusis, Arecunas, and by the "True Caribs," came also from the Islands, but at various times, and made their way, in somewhat various directions, into the back lands of the country. The first set of pictures I am about to show you all are of this last or "True Carib" branch.

The first is of a middle-aged man who lives in the first falls of the Barima River. A single glance at it and a comparison of it with the ordinary, even the best book illustrations of Caribs, will at once serve to make plain the advantage of the photographic method used among the people in their own homes over any other method of showing what these primitive folk are really like. Before shooting the falls in their canoes the Redmen always carefully examine the state of the river to see which rocks are exposed, which lurk as hidden dangers beneath the surface in that particular state of the water; and it was while he was engaged in this cautious survey that this photograph of this Carib was taken. The next is of the same man taken under somewhat different circumstances. The hospitality of these persons is almost unbounded, and the etiquette of its observance is rigidly fixed. The master of the house, when expecting guests, grooms himself carefully and puts on his best dress and ornaments, these often, as in this case, consisting only of a narrow waistcloth by way of dress and of a necklace and armlets of white beads by way of ornament. Thus honouring the occasion to the best of his ability, he sits, somewhat stolidly, outside his house awaiting his guests, with whom, when they arrive, he will, without rising or in any other way testifying any interest, exchange one or two entirely conventional and monosyllabic sentences, dropping them out one by one at long intervals.

It is generally supposed that these red-skinned folk are undemonstrative in their bearing towards one another. But this really is only in the presence of strangers. When alone, or before others with whom they are familiar, their bearing toward each other is even caressing. Such a picture as this, of three Caribs standing with their arms round each other's necks, may often be seen.

The next picture, of a young Carib man, perhaps a little above the average in physique, is intended to show that these people, though not tall, are a fine people in the point of physical and muscular development.

Again, in the matter of facial expression, the ordinary conception of these people as dull and expressionless should give place to the truer idea that, when not made shy by the presence

of unaccustomed strangers, there is a great deal of life and even in some cases of beauty in their appearance. It is practically impossible for a stranger to see them in this their more pleasing and natural state, except when, as I now do in this picture of three Carib lads, they are taken under the most natural conditions, and distance and time being for the purpose annihilated, they are shown you in the most natural conditions but without their knowledge.

That it may not be said that in my anxiety to impress you with my own too favourable ideas of these red-skinned friends of mine, I have elected only to show you young fellows in their too brief prime, I next show you an old Carib. I must, however, admit that he is only old for a Redman. His age was probably about forty-five. But these happy childlike people lead but a short if a happy life, and are old at fifty, and rarely survive to sixty. . .

Another obvious, but insufficiently used, use of the camera for anthropological purposes would be for the better illustration of collections of objects of ethnological interest. Those who have tried know best the difficulty of showing these in an effective and interesting manner. Comparatively elaborate and correspondingly artistic objects made and used by a people who have made considerable progress without attaining what we are pleased to call civilisation, are easily shown in an attractive manner; but the simpler objects, illustrating the daily life of people in a much more primitive state of civilisation, are not so easily placed. The articles which constitute the dress and ornaments of a people which makes but little use of ornament and less of dress, are generally of so simple a nature that when stored in rows or, as I am afraid is sometimes the case, in heaps or even in bundles, in museum cases, they too often seem deficient in interest to the very curators of the museum, and are naturally much more so to the outside public. Yet these same things, very likely, to one who has seen them in actual use, seem, just because of their simplicity, more interesting than the elaborate dancing masks and such like. It has been suggested—possibly the suggestion has been carried into effect—to display these on lay figures; but when it is remembered how very few of these simple articles of dress or ornament are worn at any one time, it is obvious that for their proper display in the suggested manner the number of lay figures which would be required would, for reasons both of economy and of space, make the plan ineffective. A much more feasible plan would be to place by the side of each object, or group of objects displayed, a photograph of the object—preferably of the identical object. A few examples will better explain what I mean:—

The first is a photograph of a Partamona (Ackawoi) Redman in a curious dress made and worn for a special festival celebrated by those people and called Paraseera. The dress consists of three parts, which may be described as skirt, cloak, and mask, all made of the bright greenish-yellow, immature leaves of the *Aita* palm (*Mauritia flexuosa*). Probably there is not an example of this dress in any existing museum; for it is probable that no white man except myself has ever seen it, and I frankly confess that I was deterred, as has often been the case under similar circumstances, from bringing away an example of the dress by the consideration that when seen off the body of the wearer it would look like nothing in the world but a small bundle of withered palm leaves, and would to the uninitiated seem supremely uninteresting.

The next example I show you is a picture of a Macusi lad in full dancing dress. Those who are acquainted with the ordinary heaped curiosities of the average ethnological collection will perhaps recognise the typical head-dress of bright parrot and macaw feathers, the loose hanging ruff of alternate black curassow and white egret feathers, and the strip of waist-cloth upheld by a cotton belt, which constitutes the whole of this dress; and such persons will probably recognise that these articles seen, as in this photograph, *in situ*, acquire a new interest.

Again, one of the commonest articles from Guiana seen in museums is the necklace of peccary teeth, much affected by all the Carib tribes. But in now showing you one of the finest specimens of this ornament I have ever seen, it will probably gain very much in interest from the fact that I am able at the same time to throw on to the screen a picture of the actual necklace on the Macusi, named Lonk, from whose shoulders I acquired it. And it may in passing be of interest to add that these necklaces, in the manufacture of which only the tusk teeth of the peccary are used, so that in proportion to its size each represents a very large number of animals, are most highly valued as heirlooms, and as representing the accumulated pro-

ess not only of the wearer for the time being, but also of his ancestors, for this property is handed down in the male line of descent, and is added to by each holder. . . .

In short, a good series of photographs showing each of the possessions of a primitive folk, and its use, would be far more instructive and far more interesting than any collection of the articles themselves. Or, if it is desired to illustrate not the possessions but the habits of such folk, the thing can be done in the same way. A few examples from a large series showing the games of these people will illustrate this.

Many of their games are dramatic representations of ordinary incidents in their work-a-day life. One represents their rare and eventful visits to the distant town. Of the many figures in this game one represents the fully-manned canoe in which they go on their journey down the big rivers of the country. All but two of the players, seated on the ground, the one behind the other, and each clasping the player in front of him, form a long line, which, by the action of the feet and thighs of its constituent members, drags itself slowly forward, the whole swaying from side to side. In this way—which must certainly involve a considerable amount of somewhat painful friction, considering the hardness of the stony ground traversed and the unprotectedness of the skins of the players—a very realistic representation of the forward rolling motion of a large and well-manned canoe, such as would be used on a real journey, is attained. And the illusion is assisted by the players' noisy imitation of the regular and most characteristic rhythmic beat of the paddles against the sides of the canoe, and of the shouts of the paddlers.

After several other figures, another comes, in which the players, all standing in line, each falls forward on his hands and feet, his thighs the highest part of him, so that the whole line of players, with their closely pressed bodies, forms a long tunnel, through which each player in turn has, as in a well-known figure in the old-fashioned dance of Sir Roger de Coverley, to pass, but by creeping. The journey, that is, is nearly over; and the home-comers, leaving the broad river up which they have come so far, have turned into the narrow creek or side stream densely roofed with low hanging trees, which leads directly to their homes; and under this natural tunnel the canoe has to force its way.

Other games to be seen among the Redmen of the borders of Guiana and Brazil are simple representations of the doings of animals. For instance, one represents an aguti in a pen and the attempts of a jaguar to get him out. The players form a ring, their arms round each other's necks. Inside this circle one of the players crouches, and represents an aguti—a small animal often kept in captivity by the Redmen—inside the pen. Outside the pen another player watches; it is the jaguar looking with hungry eyes on the aguti. He tries to get the aguti out between the bars of the pen, that is, between the legs of the ring of players. But the living pen whirls round and round, and it is no easy task for the jaguar to seize the aguti and drag it out.

Yet more curious is the whipping game of the Arawaks. It is played by any number of persons, but generally only by men and boys, for one, two, or three days and nights—as long, that is, as the supply of *paiuari*, the native beer, holds out. The players, with but brief intervals, range themselves in two lines opposite each other. Every now and then a pair of players, one from each line, separate from the rest. One of these puts forward his leg and stands firm; the other carefully measures the most effective distance with a powerful and special whip with which each player is provided, and then lashes with all his force the calf of the other. The crack is like a pistol shot, and the result is a gash across the skin of the patient's calf. Sometimes a second similar blow is given and borne. Then the position of the pair of players is reversed, and the flogged man flogs the other. Then the pair retire, drink good-temperedly together, and rejoin the line, to let another pair take their turn of activity, but presently, and again and again at intervals, to repeat their own activity.

It has been said that the most active players of this extraordinary game are the men and boys. But occasionally the women take a part also. And it is noteworthy that when this is the case a wooden figure of a bird, a heron, is substituted for each of the whips, and a gentle peck with this bird is substituted for the far more serious lash of the whip. I do not know that any equivalent example of the fact that the germ of the idea of courtesy to the weaker sex exists among people even in this stage of civilisation is on record.